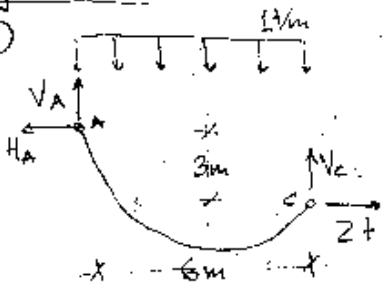
SOLUCIÓN 1º PARCIAL 03/10/2007

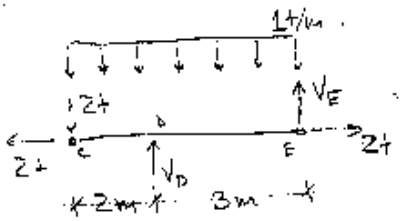
Ejercicio 1

② 

$H_A = 2t$

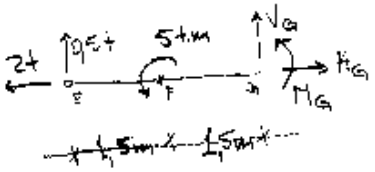
$V_A \cdot 6m = 2t \cdot 3m + 6t \cdot 3m \Rightarrow V_A = 4t$

$V_C = 6t - V_A \Rightarrow V_C = 2t$



$V_D \cdot 3m = 2t \cdot 5m + 5t \cdot 2{,}5m \Rightarrow V_D = 7{,}5t$

$V_E = 5t + 2t - V_D \Rightarrow V_E = -0{,}5t$

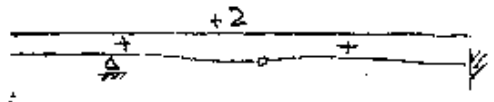


$H_G = 2t$

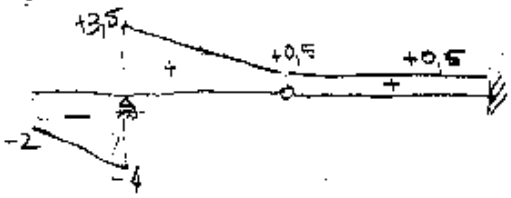
$M_G = -5t\,m + 0{,}5t \cdot 3m \Rightarrow M_G = -3{,}5t\,m$

$V_G = -0{,}5t$

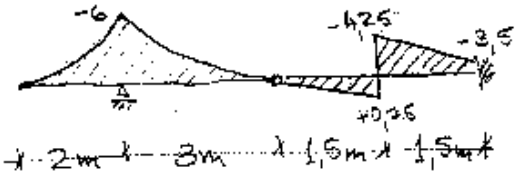
⑤ N(t)



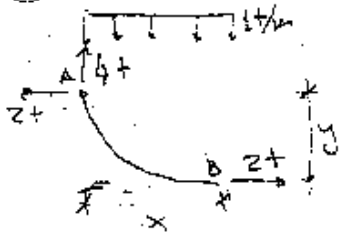
V(t)



M(tm)



⑥ Fuerza máxima en el cable $F = \sqrt{(4t)^2 + (2t)^2} = 4{,}47t$



$2t \cdot y = \frac{(1t/m)\,x^2}{2}$

$(4t)\,x - \frac{(1t/m)\,x^2}{2} - (2t)\,y = 0$

$\Rightarrow (-1t/m)\,x^2 + (4t)\,x = 0$

$x = 0$

$x = 4m$

$y = 4m$

Exercício 2.

a) $3C \overset{?}{=} 3E + 2A + B$

$C = 2$ (ABC e CDE).

$E = 1$ (A)

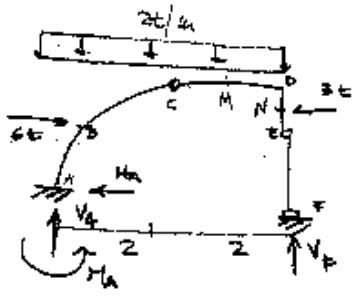
$A = 1$ (C)

$B = 1$ (Et)

$\rightarrow 2 \cdot 3 = 3 \cdot 1 + 2 \cdot 1 + 1 = 6$ ✓

$\rightarrow$ sistema invariante.

b)



$\Sigma F_V = V_A + V_F - 2 \cdot 4 = 0$

$\rightarrow V_A + V_F = 8t$.

$\Sigma F_H = 6 - 3 - H_A = 0$

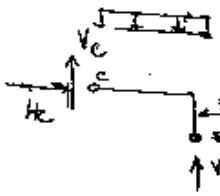
$\rightarrow H_A = 3t$

$\Sigma M_C^{der} = 2 \cdot V_F - 3 \cdot 0,5 - 2 \cdot 2 \cdot 1 = 0$

$\rightarrow V_F = 2,75t$ $\rightarrow V_A = 5,25t$

$\Sigma M_A = 6 \cdot 1 + 2 \cdot 4 \cdot 2 - 3 \cdot 1,5 - 2,75 \cdot 4 - M_A = 0$

$M_A = 6,5tm$

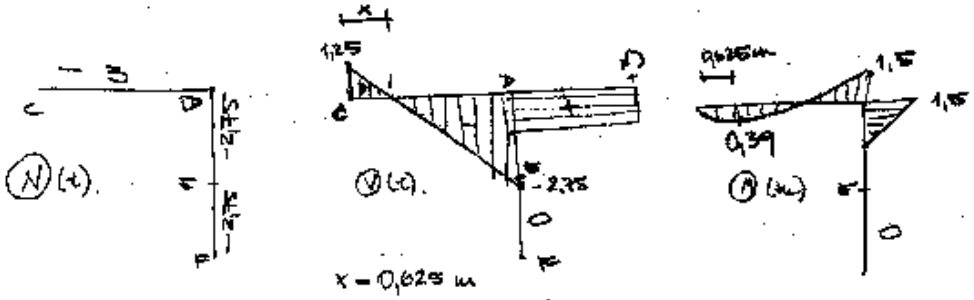


$V_E = 2,75t$

$V_C = 2 \cdot 2 - 2,75 \rightarrow V_C = 1,25t$.

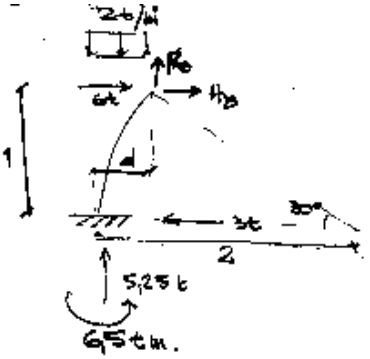
$H_C = 3t$

c)



$x = 0,625$ m

$M_x = \frac{V_x^2}{2P} = \frac{1,25^2}{2 \cdot 2} = 0,390625$ tm.



$d = 2 - 2\cos 30 = 2 - \sqrt{3} \simeq 0{,}268$

Solicitaciones a la izquierda (antes de aplicar las 6 t).

$R_B + 5{,}25 - 2(2-\sqrt{3}) = 0 \rightarrow R_B = -4{,}714\ t.$

$H_B = 3\ t.$

$V_B = H_B \cos 30 - R_B \operatorname{sen} 30 = 3\frac{\sqrt{3}}{2} + 4{,}714 \cdot \frac{1}{2} = 4{,}96\ t$

$N_B = R_B \cos 30 + H_B \operatorname{sen} 30 = -4{,}714\frac{\sqrt{3}}{2} + \frac{3}{2} = -2{,}58\ t$

$M_B = 3 \cdot 1 + 5{,}25 \cdot 0{,}268 - 2 \cdot \frac{(0{,}268)^2}{2} - 6{,}5 = -2{,}16\ t\,m$

Solicitaciones a la derecha de B.

$R_B = -4{,}714\ t$

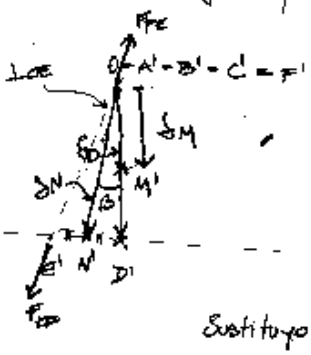
$H_B = -3\ t$

$\rightarrow$ $V_B = -0{,}24\ t$

$N_B = -5{,}55\ t$

$M_B = -2{,}16\ t\,m$

d) Corto la biela EF le impongo un desplazamiento vertical al punto D. A, B, C y F quedan fijos.



Para que la fuerza sea mínima, hago que la fuerza sea ortogonal al desplazamiento para obtener el mínimo trabajo. → La dirección óptima sea 30° con la vertical.

Sustituyo la ~~fuerza distribuida~~ por una carga puntual de 4 t en el punto medio de CD, M.

Por PTV.

$$F_{EF} \cdot \underbrace{\delta_E}_{\frac{\sqrt{3}}{2}\delta_D} + 4\,t \cdot \underbrace{\delta_M}_{\frac{\delta_D}{2}} + 3\,t \cdot \underbrace{\delta_N \cos\beta}_{\frac{\delta_D}{4}} = 0$$

$$\frac{\sqrt{3}}{2} F_{EF} = -2 - \frac{3}{4} \rightarrow F_{EF} = -\frac{11\sqrt{3}}{10} \simeq -2{,}46\ t.$$